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Concern has developed in recent years over the survivability of an airplane which has encountered major structural damage which may greatly exceed the damage limits envisioned by present fail-safe rules. It is recognized that certain structures are capable of sustaining damage far greater than that considered in the fail-safe analysis, yet retain sufficient strength to continue safe flight and land. The overall airframe is capable of carrying flight loads after receiving extensive damage to structures such as fuselage skin, bulkheads, and cabin floors.

Several accidents or near accidents might have been averted had the primary flight controls and vital systems on those airplanes been sufficiently separated and isolated to accommodate major structural failures without loss of vital controls. There are many service reports of extensive fatigue cracking and corrosion in fuselage skins, floors and bulkheads in which the pressure vessel integrity was compromised to the point explosive decompression was possible. Service experience indicates these areas have the greatest potential for safety gains through separation and isolation of vital control systems.

In responding to our recommendation for issuance of a rule requiring separation and isolation of vital flight controls, AVS-1 advised: "FAR 25.671 and 25.1309, which cover control systems and all systems respectively, require the airplane to be designed for external damage to these systems from any failure (including structural failures) which is not extremely improbable. This position is outlined in letters to the wide-body manufacturers on the initial application of FAR 25.671, in the words of FAR 25.1309, 'the analysis must consider . . . possible modes of failure, including malfunctions and damage from external sources . . . ,' and in the preamble to Amendment No. 8A. Thus, the elements of your proposal are embodied in present interpretations of existing regulations."

Accordingly, the rules should be interpreted to require each primary control system, including its structural components, cables, electrical wires, and hydraulic lines, be arranged, where practicable, so that any in-flight localized structural failure will not cause a loss of control that would prevent continued safe flight and landing.

It is recognized that certain areas of the airplane can not be fully protected against loss of controls due to structural failures. Failures of the pilots compartment floor is an area that would probably result in loss of control of the airplane and also in loss of the flight crew. Service experience has shown few problems associated with pilot compartment floors. The cockpit floors are not subjected to the same hostile environment from passenger service (such as wear and tear and corrosive liquids) as the passenger cabin floors. The cockpit floor is usually better supported and is not located directly above cargo compartments, therefore, less exposed to hazards originating in the cargo compartment. The empennage area where the controls coverage at the stabilizers is another area where physical separation of the controls by several feet may not be practical. This area is least vulnerable to in-flight damage from mid-air collision, from hazards originating in the cargo holds and is not accessible in flight. Also, should large structural damage occur in the empennage area, the airplane would probably be lost due to tail separation.

The greatest gain in safety would come from separation and from proper arrangement of vital controls in the pressurized cabin area between the pilots compartment bulkhead and the aft pressure bulkhead. This is the area where the controls are most vulnerable to inflight failures in the fuselage. Arrangement of vital controls in other areas such as engine pylon to wing attachment, in landing gear wheel wells and in flap wells should be carefully reviewed for location and isolation to minimize the damage to vital systems as a result of structural failures to these areas.

Signed by Donald L Riggin